

Abstract of the Invention

Method and system for functionalizing a collection of carbon nanotubes (CNTs). A selected precursor gas (e.g.,  $H_2$  or  $F_2$  or  $C_nH_m$ ) is irradiated to provide a cold plasma of selected target species particles, such as atomic H or F, in a first chamber. The target species particles are directed toward an array of CNTs located in a second chamber while suppressing transport of ultraviolet radiation to the second chamber. A CNT array is functionalized with the target species particles, at or below room temperature, to a point of saturation, in an exposure time interval no longer than about 30 sec. \*Discrimination against non-target species is provided by (i) use of a target species having a lifetime that is much greater than a lifetime of a non-target species and/or (2) use of an applied magnetic field to discriminate between charged particle trajectories for target species and for non-target species.